IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Shinji Maekawa	Art Unit	: 2813
Serial No.	: 09/724,403	Examiner	: Stephen W. Smoot
Filed	: November 27, 2000	Conf. No.	: 7575
Title	: METHOD OF MANUFACTURING A SEMICONDUCTOR DEVICE WITH TENSILE STRESS (AS AMENDED)		

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY TO ACTION OF MAY 8, 2006

Claims 61, 65, 66 and 71 are under consideration in this application, with claim 61 being independent. Claims 1-60, 62-64 and 67-70 have been withdrawn from consideration.

Independent claim 61 and its dependent claims 65, 66 and 71 have been rejected as being unpatentable over Nakajima (JP 11-31824 A – using U.S. Patent No. 7,026,197) in view of Okonogi (U.S. Patent No. 5,970,366). Applicants respectfully traverse this rejection.

Independent claim 61 recites a method of manufacturing a semiconductor device that includes forming a semiconductor film over a substrate and "forming a material having a tensile stress of 8×10^9 dynes/cm^2 or more in contact with the semiconductor film, whereby an impurity element is gettered into the material." Applicants request reconsideration and withdrawal of the rejection of claim 61 and its dependent claims because neither Nakajima, Okonogi, nor any proper combination of the two describes or suggests forming a material having a tensile stress of 8×10^9 dynes/cm^2 or more in contact with a semiconductor film such that an impurity element is gettered into the material.

The Examiner acknowledges that Nakajima and Okonogi do not explicitly disclose forming a material having the recited tensile stress of 8×10^9 dynes/cm^2 or more, but argues that this tensile stress limitation is "inherent to the method of Nakajima and Okonogi, per MPEP section 2112.01 because it is substantially identical to the applicant's as-claimed method. Accordingly, a *prima facie* case of obviousness has been established and the burden shifts to the applicant to show that the products produced by these methods are not the same" (page 4 of Office Action).

The Examiner seems to be asserting that the methods described by Nakajima and Okonogi inherently describe forming a material with the recited tensile stress because the methods are "substantially identical" to the applicant's "as-claimed method" in that they, according to the Examiner, describe performance of all five steps recited in claim 61, with the sole exception that the described methods do not explicitly specify the tensile stress of the material that is formed. Under this interpretation, the Examiner is apparently asserting that the material that is formed would necessarily have the recited tensile stress because such a tensile stress would naturally flow from the performance of the other steps. Applicants respectfully disagree with this assertion.

As described in the application specification, for example, on page 34, lines 6-14, formation of a silicon nitride film having the recited tensile stress requires not just formation of a silicon nitride film but also requires an additional heat treatment specifically designed to increase the tensile stress of the silicon nitride film to the desired 8×10^9 dynes/cm^2 or more. This additional heat treatment does not flow naturally from the other steps in the method recited in claim 61, but rather is an entirely separate and distinct operation that is performed solely to enable formation of a silicon nitride film having the desired tensile stress. Accordingly, "forming a material having a tensile stress of 8×10^9 dynes/cm^2 or more" is not inherently described by a reference that teaches the other steps of claim 61. Thus, for at least this reason, even if Nakajima and Okonogi were to describe the other steps of claim 61, Nakajima and Okonogi still would not inherently describe this feature.

Moreover, it is important to note that Nakajima and Okonogi do not recognize the importance of forming a material such that it has a high tensile stress for the purpose of improving the ability of the material to getter impurities. Rather, Nakajima relies on a gettering process that includes forming an amorphous semiconductor film 106 that is heavily doped with phosphorus for gettering while Okonogi relies on a gettering process that includes forming a silicon nitride film and an oxygen implanted layer for gettering.

For at least the above reasons, applicants request reconsideration and withdrawal of the rejection of the rejection of claim 61 and its dependent claims 65, 66 and 71.

Applicants further request reconsideration and withdrawal of the rejection of claim 65, which depends from claim 61, for the additional reason that neither Nakajima, Okonogi, nor any proper combination of the two describes or suggests the method of manufacturing a semiconductor device recited in claim 61 "wherein said material is a silicon nitride film formed by LPCVD."

Nakajima describes a gettering process that uses plasma assisted CVD or LPCVD to form an amorphous silicon film 106 that is heavily doped with phosphorus, which the Examiner equates to the recited material, on a crystalline silicon film 104. A heat treatment is then performed whereby metallic elements from the crystalline silicon film 104 are absorbed in the amorphous silicon film 106. See col. 4, lines 32-52 and Figs. 1B-1D. The Examiner acknowledges that Nakajima does not describe or suggest the feature "said material is a silicon nitride film formed by LPCVD."

The Examiner refers to Okonogi as describing this feature, stating that "Okonogi teaches that silicon nitride formed by low pressure chemical vapor deposition (LPCVD) can be used as an alternative to amorphous silicon for extrinsic gettering (see column 3, lines 51-67)" and, therefore, "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to substitute silicon nitride, as taught by Okonogi, for the amorphous silicon film (106) of Nakajima. Okonogi recognizes that silicon nitride and amorphous silicon are equivalent materials that can be used for gettering (see column 3, lines 51-67)." Applicants disagree with the Examiner's characterization of Okonogi's teachings and assert that a person of ordinary skill in the art at the time of the invention would not have been led to replace Nakajima's amorphous silicon film 106 with Okonogi's silicon nitride film in Nakajima's gettering process as suggested by the Examiner.

In particular, the portions cited by the Examiner only indicate that a polysilicon film, an amorphous silicon film, and a silicon nitride film may be used as equivalent alternatives in Okonogi's specific gettering process. Okonogi's specific gettering process, however, is substantially different from the gettering process described by Nakajima and, therefore, a person of ordinary skill in the art at the time of the invention would not have been led to conclude, based

on the teachings of Okonogi, that a silicon nitride film could be used in place of the amorphous silicon film 106 in Nakajima's gettering process. As stated above, Nakajima's gettering process includes forming an amorphous silicon film 106 that is heavily doped with phosphorus on a crystalline silicon film 104 and subsequently performing a heat treatment whereby metallic elements are absorbed in the amorphous silicon film 106. In contrast, Okonogi's gettering process includes forming a silicon nitride film 2 by LPCVD on a bottom surface of a single crystal silicon substrate 1, implanting oxygen ions 3 in the top surface of the single crystal silicon substrate 1 to form an oxygen implanted layer 4, and performing a heat treatement, whereby metallic elements and interstitial silicon generated by the implantation of oxygen ions or discharge holes are absorbed in the silicon nitride film 2. See col. 3, line 49 to col. 4, line 18 and Figs. 2A and 2B. These two gettering processes are substantially different, and, therefore, a description that a material may be substituted for another in one of the two processes does not lead to the inference that a similar substitution may be done in the other process.

Accordingly, for at least this further reason, applicants request reconsideration and withdrawal of the rejection of claim 65.

Applicants submit that all claims are in condition for allowance.

No fees are believed due. Please apply any charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: 8/8/06

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